AMENDMENTS

In the Claims

This listing of claims replaces all prior versions and listings of the claims. The status of each claim is indicated. Amendments are shown with additions underlined and deletions in ~~strikethrough~~ text. No new matter is added by these amendments.

Listing of Claims

1. (Currently Amended) A method of placing pilot symbols in a data stream for telecommunications systems, ~~wherein~~ comprising:

distributing the pilot symbols ~~are distributed~~ in time using a range of different intervals between symbols.

2. (Currently Amended) The method of ~~A method in accordance with~~ claim 1, wherein the distributing includes distributing the ~~distribution of~~ pilot symbols in time ~~is~~ in a manner substantially fractal in nature.

3. (Currently Amended) The method of ~~A method in accordance with~~ claim 2, wherein the distributing includes repeating ~~distribution of pilot symbols involves repetitions of~~ irregular groupings of pilot symbols in the data stream.

4. (Currently Amended) The method of ~~A method in accordance with~~ claim 3, wherein said irregular groupings of pilot symbols are irregularly spaced in the data stream.

5. (Currently Amended) The method of claim ~~4~~ 1,

wherein the data stream ~~comprises~~ includes a data ~~packet,~~ packet; and

wherein the ~~pilot symbols are placed~~ distributing includes:

placing the pilot symbols with irregular spacing within a first level group (L0 level); ~~,~~

repeating the irregular spacing ~~is repeated~~ in a plurality of such L0 groups; ~~,~~ and

placing the L0 groups ~~are placed~~ with irregular spacing within a second level group (L1 level).

6. (Currently Amended) The method of claim 5, wherein the distributing includes:

repeating the irregular spacing between the L0 groups ~~is repeated~~ in a plurality of L1 groups across the data ~~packet,~~ packet; and

placing the L1 groups ~~are placed~~ with irregular spacing within a third level group (L2 level).

7. (Currently Amended) The method of claim 6, wherein each L0 group has length A, each L1 group ~~each~~ has length B, and the L2 group has length C, the pilot symbol distribution selected such that the ratio A:B is approximately equal to the ratio B:C.

8. (Currently Amended) The method of claim ~~7~~ 1, wherein the distributing includes distributing the pilot symbols in time using a range of different intervals such that the pilot symbols extend across substantially the entirety of the data packet.

9. (Currently Amended) The method ~~of in accordance with~~ claim 8, wherein the distributing includes determining the spacing of the pilot symbols ~~is decided~~ in accordance with a mathematical relationship, such that their positions are substantially predictable, but sufficiently unevenly spaced to improve the ratio of the pilot symbol spectrum corresponding to the most likely frequency to that of the next most likely frequency, when compared with that available from an equivalent data stream containing evenly spaced pilot symbols.

10. (Currently Amended) A signal processing device for use in a communications system, the signal processing device comprising:

a data source configured to generate ~~for generating~~ a data stream for telecommunications ~~systems,~~ systems; and

a pilot symbol placer configured to place pilot symbols in the data stream, such that the ~~the signal processing device configured, wherein~~ pilot symbols are spaced in time using a range of different intervals between symbols.

11. (Currently Amended) A ~~receiver~~ method for receiving and acquiring a transmitted signal in a communications system, the signal representing a data stream including data symbols and pilot symbols, the method comprising ~~including the steps of~~:

receiving the transmitted signal and converting to a digital signal; and

acquiring by iteration the frequency of the signal by ~~the following steps~~:

calculating a first estimate of phase and signal amplitude based on an assumed zero phase difference between certain ~~relatively~~ closely spaced pilot symbols within the data stream;

calculating a ~~relatively~~ fine frequency estimate with ~~potential~~ aliasing ambiguity based on more widely spaced pilot symbols within the data stream;

using said ~~relatively~~ fine frequency estimate to calculate a phase difference between said ~~relatively~~ closely spaced pilot symbols, and calculating a ~~relatively~~ coarse frequency estimate based on this phase difference, with no aliasing ambiguity;

using the calculated ~~relatively~~ coarse frequency estimate to enhance the ~~relatively~~ fine frequency estimate by refining said calculated phase and signal amplitude, and thus re-calculating said ~~relatively~~ fine frequency estimate;

using said ~~relatively~~ coarse frequency estimate and the enhanced ~~relatively~~ fine frequency estimate to resolve the ~~potential~~ aliasing ambiguity in the ~~relatively~~ fine frequency estimate; and

applying the enhanced ~~relatively~~ fine frequency estimate to the data stream in the acquisition of the data symbols.

12. (Currently Amended) A ~~receiver~~ method for receiving and acquiring a transmitted signal in a communications system, the signal representing a data stream including data symbols and pilot symbols, the method ~~including the steps of:~~ comprising:

receiving the transmitted signal and converting to a digital signal; and

acquiring the frequency of the signal by ~~the following steps~~:

a) a medium frequency estimation ~~step~~;

b) a coarse frequency estimation ~~step~~ based on the result of ~~step~~ (a);

c) a medium frequency re-estimation ~~step~~ based on the result of ~~step~~ (b);

d) an adjustment to the medium frequency estimation to resolve ~~potential~~ aliasing ambiguities in the medium frequency estimation;

e) a fine frequency estimation ~~step~~, including a calculation of a likelihood for the selected frequency; and

f) an adjustment to the fine frequency estimation to resolve ~~potential~~ aliasing ambiguities in the fine frequency estimation;

13. (Currently Amended) The ~~receiver~~ method of claim 12, ~~including the further step of:~~ further comprising:

g) ~~a~~ phase and signal estimation and correction ~~step~~ based on the result of ~~step~~ (f).

14. (Currently Amended) The ~~receiver~~ method of claim 13, ~~including the further step of:~~ further comprising:

h) ~~the removal of~~ removing the pilot symbol from the data stream to provide a data symbol output.

15. (Currently Amended) The ~~receiver~~ method of claim 13, ~~including the further step of variance estimation.~~ further comprising:

estimating variance.

16. (Currently Amended) The ~~receiver~~ method of claim 15, ~~including a process for further improving~~ wherein the reliability of the acquiring is improved ~~acquisition~~ by using additional encoded pilot symbols embedded within the data stream, the additional pilot symbols encoded

with forward error correcting ~~codes;~~ codes, the method further comprising: ~~process including the steps in the receiver of:~~

acquiring a list of the most probable time and frequency offset pairs ranked in order of probability;

starting with the highest probability, and proceeding in order of decreasing probability for each said time and frequency offset pair in the list:

decoding the packet on the basis of the time and frequency offset;

accepting the time and frequency offset if a predetermined number of said additional encoded pilot symbols match their prescribed values; and

continuing to the next time and frequency offset pair in the list if the predetermined number of said additional encoded symbols do not match their prescribed values.

17. (Currently Amended) The ~~receiver~~ method of claim 16, wherein the pilot symbols are spaced in time using a range of different intervals between symbols.

18. (Currently Amended) The ~~receiver~~ method of claim 17, enhanced for greater data transmission efficiency, wherein ~~in the data stream selected~~ one or more of the pilot symbols in the selected data stream are replaced with data symbols, and the acquiring the frequency of the signal is ~~acquisition steps are applied~~ based on the assumption that these selected symbols are pilot symbols with zero value.

19. (Currently Amended) A receiver for receiving and acquiring transmitted signals in a communications system, the signals representing a data stream including data symbols and pilot symbols, the receiver comprising: ~~including:~~

a functional block for receiving the transmitted signal and converting to a digital signal; and

a functional block for iteratively acquiring the frequency of the signal, including: ~~comprising:~~

a functional block for calculating a first estimate of phase and signal amplitude based on an assumed zero phase difference between certain ~~relatively~~ closely spaced pilot symbols within the data stream;

a functional block for calculating a ~~relatively~~ fine frequency estimate with ~~potential~~ aliasing ambiguity, based on more widely spaced pilot symbols within the data streams;

a functional block for using said ~~relatively~~ fine frequency estimate to calculate a phase difference between said ~~relatively~~ closely spaced pilot symbols, and calculating a ~~relatively~~ coarse frequency estimate based on this phase difference, with no aliasing ambiguity;

a functional block for using the calculated ~~relatively~~ coarse frequency estimate to enhance the ~~relatively~~ fine frequency estimate by refining said calculated phase and signal amplitude, and thus re-calculating said ~~relatively~~ fine frequency estimate;

a functional block for using said ~~relatively~~ coarse frequency estimate and the enhanced ~~relatively~~ fine frequency estimate to resolve ~~potential~~ aliasing ambiguity in the ~~relatively~~ fine frequency estimate; and

a functional block for applying the enhanced ~~relatively~~ fine frequency estimate to the data stream in the acquisition of the data symbols.

20. (Currently Amended) A receiver for receiving and acquiring transmitted signals in a communications system, the signals representing a data stream including data symbols and pilot symbols, the receiver comprising: ~~including:~~

a functional block for receiving the transmitted signal and converting to a digital signal; and

a functional block for acquiring the frequency of the signal, including:

a) a functional block for carrying out a medium frequency estimation ~~step~~;

b) a functional block for carrying out a coarse frequency estimation ~~step~~ based on the result of ~~step~~ (a);

c) a functional block for carrying out a medium frequency re-estimation ~~step~~ based on the result of ~~step~~ (b);

d) a functional block for carrying out an adjustment to the medium frequency estimation to resolve ~~potential~~ aliasing ambiguities in the medium frequency estimation;

e) a functional block for carrying out a fine frequency estimation ~~step~~, including a calculation of a likelihood for the selected frequency;

f) a functional block for carrying out an adjustment to the fine frequency estimation to resolve ~~potential~~ aliasing ambiguities in the fine frequency estimation.